

# Arkema Inc. Response

Crosby, TX



## U.S. EPA - Region 6 Emergency Management Branch



## Background:

- 340K lbs of heat sensitive Peroxides that react if not kept cold, causing violent fire and/or explosion
- 1M lbs of “ambient” Peroxide, 47K lbs of SO<sub>2</sub>, 38K lbs of Isobutylene, 300 lbs of Chlorine, and other acids/caustics
- Rural with few homes nearby. Adjacent highway and railroad
- 57 employees
- RCRA, RMP, EPCRA, TRI
- Backup generators to keep peroxides cooled

Ambient – remains stable at cool temps. Less sensitive to heat and does not require extremely low temps.





## Aug 25 – 28, 2017

- Facility shuts down for Harvey. Nine diesel-powered refrigerated trailers (reefers) brought in as an additional backup cooling system
- Generators lost power when flooded. Facility moves sensitive peroxide moved into reefers
- Facility is evacuated. Ride-out team stays in place to maintain reefers cooling systems
- Flood reaches the reefers and ride-out team unable to refuel cooling units. Due to safety, the team is evacuated. Reefers shutting down and temps rising.
- One reefer leaning against the warehouse storing 1M lbs of ambient peroxide due to flood waters



1 Reefer = 38K lbs of heat sensitive peroxide









## Aug 29 – 31

- Remote sensors indicate that Self-Accelerating Decomposing Temps (SADT) are reaching critical levels
- Situation critical. RP, TCEQ, Harris Co HAZMAT, and Crosby FD establish UC. ***“The potential for a reaction leading to fire and/or explosion... is real”*** RP statement
- UC establishes 1.5 mile radius exclusion based on a National Atmospheric Release Advisory Center model.
- TCEQ asks EPA R6 for assistance. EPA R6 approaches IMAAC for plume models. First models are delivered based on limited info. On 8/30 EPA ASPECT conducts first sweep of facility. Non-Detects (ND)
- On 8/30 the reefers start running out of fuel with some of the temp sensors malfunctioning. EPA R6 OSC with air monitoring teams ready to deploy
- At 0245 on 8/31 the first reefer self ignites after “popping” sounds are heard outside the exclusion zone. **OSC deploys and joins the UC upon arrival**



# First Reefer to Self-ignite

EPA-R6 Arkema ER



Photo by the US Chemical Safety Board



## Aug 29 – 31 (cont.)

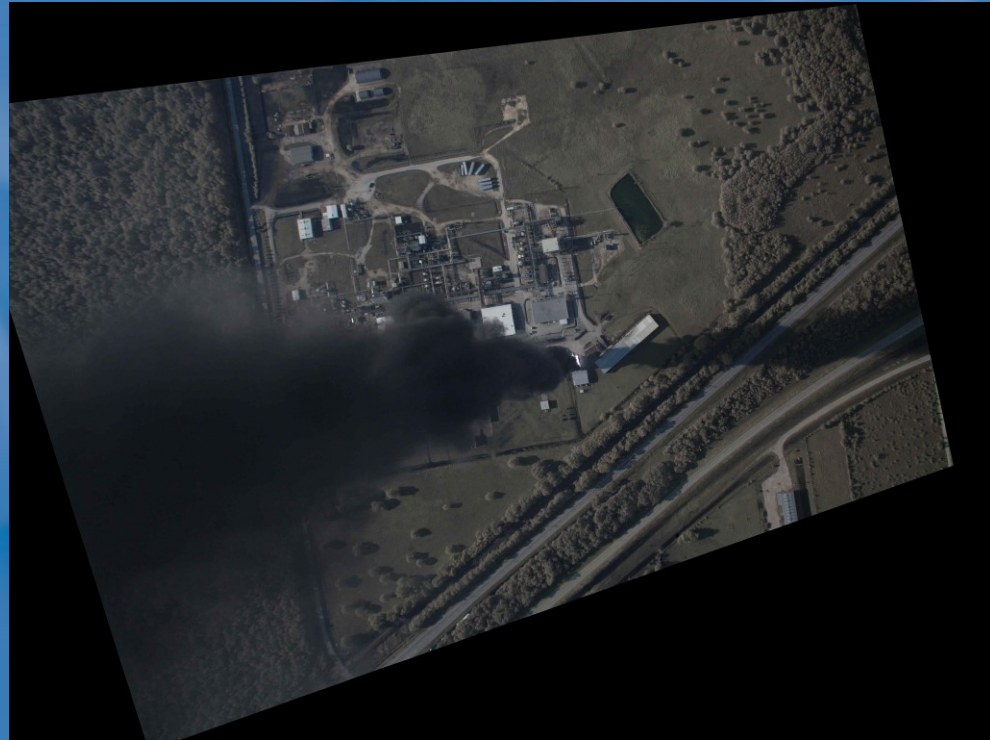
- IMAAC begins to provide revised models as updated chemical volumes and locations are provided by the RP, and wind conditions change
- Two initial potential main scenarios:
  - Peroxides reacting into hydrogen peroxides after contact with floodwaters (minimal to no exposure)
  - Explosion/fire of one or multiple reefers with up to a ½ mile radius impact area for exposure. If SO2 unit affected up to 3.3 mile possibility for downwind exposure
- After the initial fire ASPECT detects very low peroxides and butylene at facility fence line. EPA R6 teams established outside the exclusion zone on a 24-hr basis
- On 8/31 Harris Co asks the EPA R6 OSC for assistance sampling floodwaters within the community downstream from the plant
- At 1420 on 8/31 three of the reefers are close to SADT and decomposition could occurred at any time. More popping sounds reported but reefers cooled down overnight. Sounds believed to be Peroxide containers over pressurizing





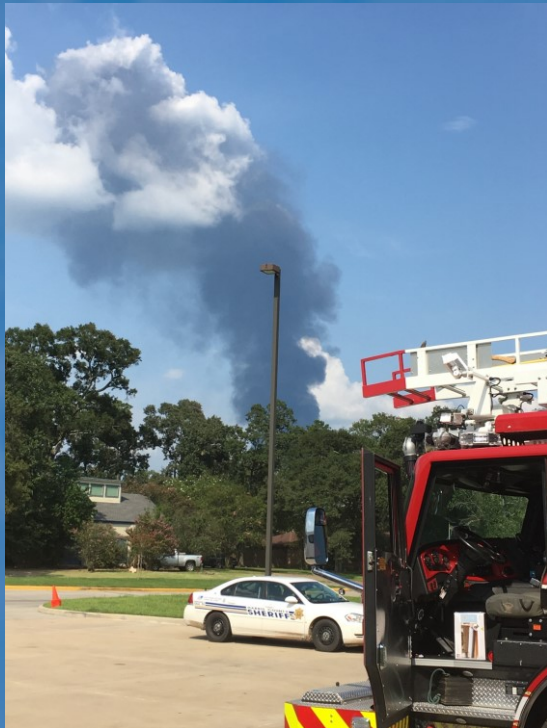
## Sep 1 – 3

- Based on the behavior from the first fire, the RP believes that the Peroxides on remaining reefers will degrade as intense fire but **no explosion**.
- At 1635 on 9/1 the 2 reefers to the west of the initial fire self ignite. Event lasts less than 1 hr. Traces of Peroxides and Butylene are detected by ASPECT
- Flood receding and UC considers a controlled and manual ignition of the remaining 6 reefers if weather and wind conditions are favorable
- On 9/2 an overflight shows yellow material leaking from the reefers, possibly Peroxides from burst containers. Material could get close to the Isobutylene tank
- Updated models indicate that Isobutylene tank could increase fire intensity



## Sep 1 – 3 (cont.)

- At 1530 on 9/3 the plan for the controlled burn is executed by the Harris Co. Bomb Squad. The event last 40 mins. During the event Aspect detects only traces of Peroxide. Ground crews measures Non-Detects

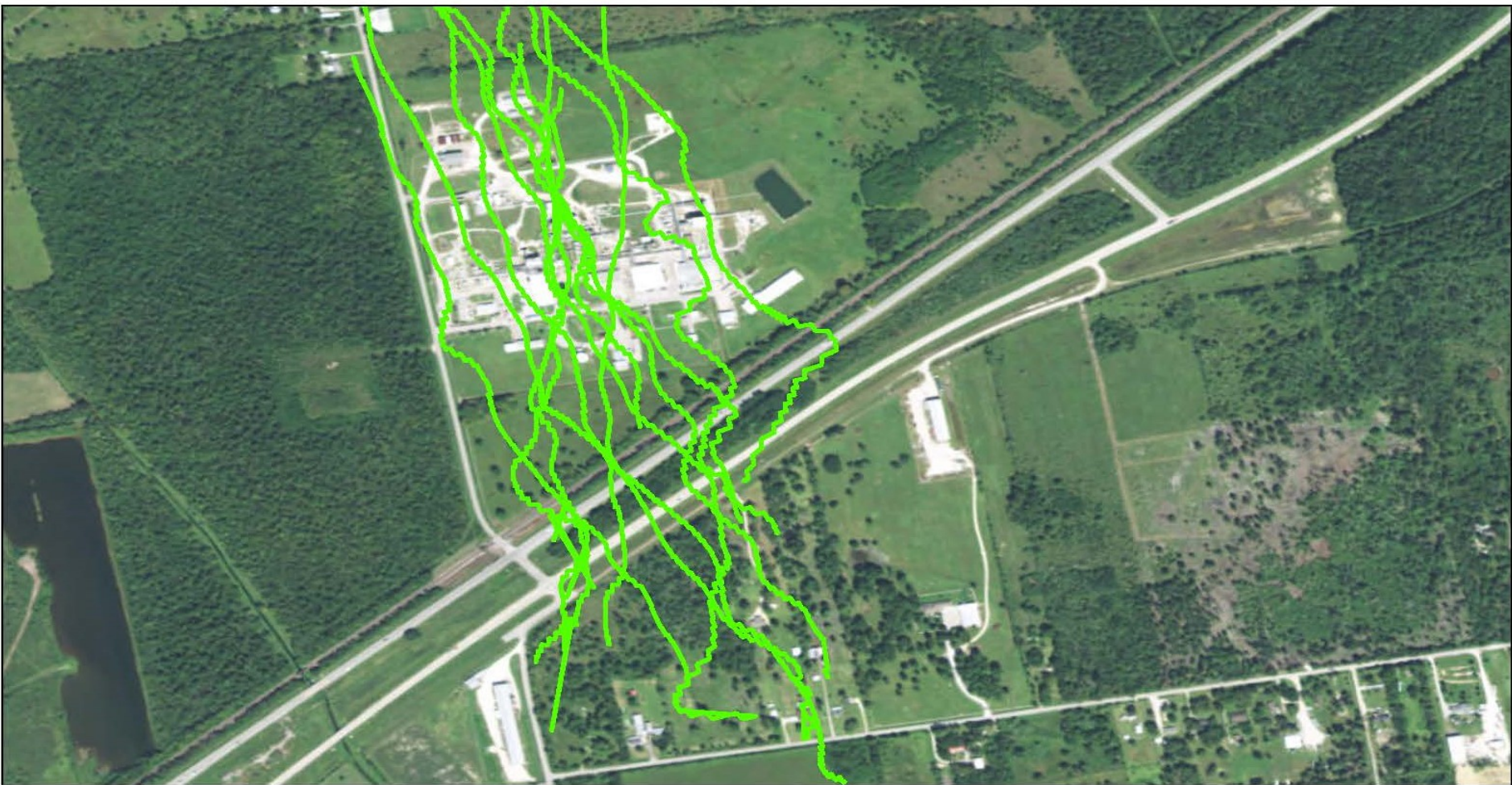




# ASPECT Sequence Photography of Controlled Ignition Event







Chemical Compounds	Short-term AMCV (ppm)
1,1-dichloroethane	1.0
1-butene	27
acetone	11
dichlorodifluoromethane	10
ethyl acetate	4
ethylene	500
isobutane	33
methyl ethyl ketone	20
methylene chloride	3.4
n-butyl acetate	7.4
n-propyl acetate	2
propylene	Simple Asphyxiant
vinyl chloride	27

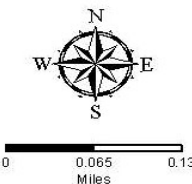
### Legend

 No Readings Above Benchmarks

#### What's an AMCV?

AMCV is a collective term used to describe chemical-specific air concentrations used to evaluate air monitoring data that are set to protect human health and welfare. Short-term AMCVs are based on data concerning acute health effects. **AMCVs** may contain health-based Reference Values (ReVs) and health- and welfare-based ESL values. AMCVs are screening levels used in TCEQ's evaluation of ambient air monitoring data to assess the potential for measured concentrations of specific chemicals to cause health or welfare effects. Health-based AMCVs are safe levels at which exposure is unlikely to result in adverse health effects. ESLs are screening levels used in the TCEQ's air permitting process to establish maximum emission rates that are written into enforceable air permits. Health-based **ESLs** are set 70 percent lower than the safe level, or AMCV. This additional buffer allows TCEQ to take into account exposure to chemicals from multiple sources in air permit reviews.

## USA EPA REGION 6 Flight 13 ASPECT



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Photo by the US Chemical Safety Board

The 1.5 mile exclusion zone is lifted later that evening. Ground teams monitor inside the exclusion up to the fence line with Non-Detects

UC demobs on 9/4.

CSB initiates investigation.  
TCEQ and Harris Co. Pollution Control follows up with post environmental impact. EPA R6 Enforcement investigates under RMP

